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Indian Standard

RECOMMENDED PRACTICE FOR PREPARATION OF IRON AND STEEL FOR ELECTROPLATING

PART III IRON CASTINGS

(First Revision)

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RECOMMENDED PRACTICE FOR PREPARATION OF IRON AND STEEL FOR ELECTROPLATING

PART III IRON CASTINGS

(First Revision)

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RECOMMENDED PRACTICE FOR PREPARATION OF IRON AND STEEL FOR ELECTROPLATING

PART III IRON CASTINGS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part III) (First Revision) was adopted by the Indian Standards Institution on 10 June 1980, after the draft finalized by the Metallic Finishes Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 The procedure for preparation of iron and steel for electroplating was earlier covered in IS : 1985-1962*. While reviewing this standard, it was decided to cover various subjects involved in the preparation of iron and steel including iron castings in three parts. The other two parts relate to low carbon and high carbon steels respectively. The recommended practice is intended to assist the platers in establishing and maintaining satisfactory precleaning cycle for preparation of malleable iron, grey iron, nodular iron and white iron castings. Certain foundry practices which are required to facilitate subsequent finishes have also been included in Appendix A. However, this standard is not intended as a standardized procedure and should be used merely as a guide. The sequence of the individual cycles and the concentration of the various solutions are flexible and may be varied to fit the conditions of the individual plating department. Preparation of non-ferrous metals for electroplating will be covered in separate standard(s).

1. SCOPE

1.1 This standard (Part III) describes the procedure for preparation of all types of iron castings for electroplating.

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*Code of practice for pretreatment of steel, copper and copper base alloys, zinc and zinc base alloys for electroplating.

2. PROCEDURE FOR RACKED PARTS

2.0 The following cycle may be used for racked parts which are to be subsequently plated.

2.1 Precleaning — Lubricants and finishing compounds should be removed immediately following the operations such as machining, polishing, buffing, etc. Some of the lubricants such as those containing unsaturated oils are not easy to remove as they form films after oxidation.

2.1.1 Organic solvents, vapour type degreasers and emulsion cleaners may be employed when excessive amounts of cutting oils used for machining operations are present.

2.1.2 Rusting of parts may be prevented by allowing as short a time as possible between the precleaning and preplating cleaning cycle.

2.2 Soak Cleaning — Soak cleaning is recommended in those cases where the parts are heavily soiled and in which case it may be difficult to loosen the oils or greases from the parts. For this purposes, emulsion-type cleaners or baths consisting of alkaline solutions may be employed as per manufacturer's instructions. In either case, agitation of the solution by air or movement of the part will prove beneficial. The time required may be 5 minutes or more.

2.2.1 *Rinse* — A luke-warm rinse (about 45°C) is desirable following the alkaline soak cleaning. In case cold water rinse is used, spraying of the part before it leaves the tank is beneficial. Time of rinsing depends upon the shape of the part and should not be less than 10 seconds.

2.3 Anodic Cleaning — The part is made the anode in a solution of a alkaline cleaner of concentration recommended by the manufacturer. The cleaner should be free-rinsing and of high conductivity so as to permit a current density of 600 to 1 000 A/m^2 at a tank voltage of 6 to 9 volts. The solution temperature should be from 90 to 100°C and the cleaning time one to two minutes.

2.3.1 *Rinse* — Rinsing should be done as described under **2.2.1** but preferably in a separate tank. Where practicable, all rinses should be double rinses; or counterflow or cascade systems for water economy.

2.4 Acid Pickling — If the electroplating is to be done under conditions causing sufficiently high hydrogen overvoltage (most acid solutions, and such alkaline solutions as copper, cadmium or tin), a brief dip (less than 15 seconds) in hydrochloric acid (20 percent, *v*/*v*) or sulphuric acid (5 to 10 percent, *v*/*v*) at room temperature is enough. If the plating is to be done in alkaline solution of low hydrogen voltage such as cyanide zinc, the part should be then made the anode in a solution of sulphuric acid (25 to 30 percent by volume) for at least 30 seconds at a voltage sufficient to provide a current density of at least 1 000 A/m^2.

2.4.1 *Rinse* — The part should be rinsed in cold water as described in **2.2.1** but in a separate tank.

2.5 Anodic Cleaning — The casting should be subjected to anodic cleaning as described in **2.3** using either the same type of proprietary cleaner or a room temperature solution consisting of sodium cyanide (30 to 45 g/l) and sodium hydroxide (30 to 50 g/l).

2.5.1 *Rinse* — The part should be rinsed in cold water as described in **2.3.1** but in a separate tank.

2.6 Activation — If electroplating is to be done in alkaline solutions, such as cadmium, copper, tin, or zinc, no further treatment should be necessary. For nearly neutral or acid plating processes, however, parts should be immersed for 5 to 15 seconds in solution of sulphuric acid (5 to 10 percent by volume) at room temperature.

2.6.1 *Rinse* — Activated parts should be rinsed in cold water as described in **2.3.1** but in a separate tank.

3. VARIATION IN PROCEDURE FOR PARTS TO BE RACKED

3.1 Where parts are subjected to several operations, prior to electroplating, such as machining, forming, polishing, etc, thought should be given to possible precleaning between operations.

3.2 Mineral oils, particularly in recesses, are best removed by vapour-phase solvents.

3.3 Lubricating oils, buffing compound greases and the like are best removed by anodic electrocleaning as described in **2.3** while heavy deposits of dried on buffing compound may be more easily removed by cathodic cleaning under similar operating conditions.

3.4 Castings which have been permitted to become heavily rusted may be pickled in sulphuric acid (5 to 10 percent by volume) containing a suitable inhibitor to prevent excessive attack on the basis metal. Preferably, the solution should be operated at 65 to 95°C and the time should be as required to remove the scale.

3.5 Very heavy scale may be more effectively removed in a shorter time by making the work anodic in a solution as described in **2.3** but with a suitable wetting agent *in lieu* of the inhibitor.

3.6 For castings from which moulding sand has not been completely removed by the abrading processes described in Appendix A, a dip in a solution consisting of one part sulphuric acid and one part hydrofluoric acid for every 4·5 litre may be employed.

3.7 A suggested alternative for most of the cycle described in **2** is the use of one of the several proprietary processes involving molten caustics, hydrides, or alkaline salts, both with and without electrolysis. The suppliers of these processes should be consulted for details.

4. PROCEDURE FOR PARTS TO BE PROCESSED IN BULK

4.1 Castings to be cleaned in cylinders other than those in which the plating is to be done should be processed through a cycle as follows.

4.1.1 *Tumble Cleaning* — Parts are cleaned by tumbling without current in a solution of properly compounded alkaline cleaners of 45 to 90 g/l for at least 5 minutes. Warm alkaline cleaner is preferable.

4.1.2 *Rinse* — Rinse for at least one minute by tumbling in warm water, preferably agitated and overflowing.

4.1.3 *Acid Pickle* — Tumble the parts for at least one minute in a solution of sulphuric acid (25 to 35 volume percent).

4.1.4 *Rinse* — Tumble in cold water, preferably agitated and freely overflowing, for at least one minute.

4.1.5 *Activation* — Parts to be plated in acid plating solutions may be transferred to plating cylinders without further processing. Parts to be plated in cyanide solutions should be tumbled for at least one minute in a room temperature solution consisting of 15 to 30 g/1 of sodium cyanide and 15 to 30 g/1 of sodium hydroxide.

4.1.6 *Rinse* — Parts activated as in **4.1.5** should be tumbled in cold water as described in **4.1.4**, but in a separate tank.

4.1.7 *Storage* — If some time is to elapse between cleaning and plating, parts may be stored in a solution as described in **4.1.5**. Castings to be subsequently plated in acid baths after storage shall first be rinsed as described in **4.1.4**, then tumbled for one minute in a solution containing 3 to 5 volume percent sulphuric acid, and rinsed again as described in **4.1.4** before transferring to the plating cylinders. At best, it is not advisable to store castings for any length of time in such cyanide solutions, as salts may be retained in the pores and cause eventual spotting out.

5. VARIATIONS IN PROCEDURE FOR PARTS TO BE PROCESSED IN BULK

5.1 Where both cleaning and plating is to be done in the same barrel, using insulated cylinders, a cycle as described for racked work may be employed except that solution temperatures shall be kept within the limits prescribed by the manufacturer of the barrels and times increased by a factor of two or three to compensate for any lowering of temperature.

5.2 Electrolytic processes such as anodic cleaning and pickling should be carried out at a minimum of 12 to 15 V, so as to get maximum current possible on the work within the temperature and current limits of the cylinder construction. Too low a current may not remove the smut and too high may damage the cylinder.

5.3 Where possible, precleaning should be done as prescribed for racked work in **2.1.1** and **2.1.2**.

NOTE 1 — *Zinc Plating* — Occasionally there is difficulty in the plating of certain castings which may be overcome by preceding the zinc plating with a strike such as cadmium, tin-zinc, tin, acid zinc, etc.

NOTE 2 — *Chromium Plating* — Variations in cleaning and pickling times should be investigated to find the optimum, especially in the case of chromium and cyanide zinc plating. In certain cases it may be desirable even to omit any preliminary wet processing and to resort to grit blasting.

APPENDIX A

(*Clauses* 0.2 *and* 3.6)

RECOMMENDED FOUNDRY PRACTICE

A-1. The seacoal content of the moulding and facing sands should be maintained at the maximum practicable limits to minimize the occlusion of sand on the surface of the castings.

A-2. Upon removal from the moulds, castings should be subjected to an abrading action (such as tumbling, grit blasting, or shot blasting) to remove as much as possible of any occluded moulding sand. Residual sand and scale may be removed, if necessary, by treatment in various proprietary descaling baths which are usually based on fused caustic soda, some of which use chemical oxidizing or reducing agents and others employ electrochemical action as well. This is particularly important in the case of castings which are to be annealed, to prevent the burning on of sand during this operation. Castings which will be warped or damaged by a blasting operation may be pickled in sulphuric acid (20 to 25 volume percent) to remove occluded moulding sand.

A-3. Annealed castings should be given an additional abrading as described in **A-2** to remove any scale, which may have been formed, as well as graphitic carbon, which may be present at the surface.

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CODES OF PRACTICE FOR METALLIC FINISHES

IS :

1340-1977	Code of practice for chromate conversion coating on zinc and cadmium coated articles and zinc base alloys (*first revision*)
1985-1962	Code of practice for pretreatment of steel, copper base alloys, zinc and zinc base alloys for electroplating
1985	Recommended practice for preparation of iron and steel for electroplating:
(Part I)-1980	High carbon steel (*first revision*)
(Part II)-1980	Low carbon steel (*first revision*)
(Part III)-1980	Iron castings (*first revision*)
1986-1962	Code of practice for hard chromium plating on steel
2450-1963	Recommended practice for plating on aluminium and its alloys
3194-1980	Recommended practice for cleaning metals prior to electroplating (*first revision*)
3655-1966	Recommended practice for electroplating
3656-1968	Code of recommended practice for mechanical polishing of metals for electroplating
5925-1970	Recommended practice for silver plating for general engineering purposes
6586-1972	Recommended practice for metal spraying for protection of iron and steel
7088-1973	Recommended practice for anodizing aluminium and its alloys
	Recommended practice for preparation of copper and copper-base alloys for electroplating

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